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The effects of incorporating NETC school enrollment data in the Navy's reenlistment prediction (ROGER) model

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THESIS

THE EFFECTS OF INCORPORATING NETC SCHOOL ENROLLMENT DATA IN THE NAVY'S REENLISTMENT PREDICTION (ROGER) MODEL

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June 2009

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13. ABSTRACT (maximum 200 words)

The Navy's Selective Reenlistment Bonus Management System (SRBMS) uses a model known as ROGER to identify the SRB-eligible population and to predict the number of SRB takers for the following fiscal year. The Enlisted Bonus Manager uses the ROGER model to determine the SRB plans during the execution year. Over the years, constant changes in the structure of the SRB program have led to increasing levels of predictive error in the ROGER model. Specifically, the ROGER model has routinely under-identified the SRB-eligible population, which, in turn, led to under-predictions in the size of the predicted number of SRB takers and the SRB budget.

The objective of this thesis is to determine whether the predictive errors in the Navy's SRBMS (ROGER) model can be reduced by accounting for new NEC/skill acquisition by sailors each fiscal year. NEC/skill acquisitions are accounted for by incorporating data into the ROGER model from the Naval Education and Training Command (NETC) on annual school enrollments and graduations. This thesis analyzes the impact of adding the NETC skill acquisition data to the ROGER model by analyzing the predicted SRB-eligible population and the predicted number of SRB takers and by assessing the resulting impact on the predicted SRB budget.

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THE EFFECTS OF INCORPORATING NETC SCHOOL ENROLLMENT DATA IN THE NAVY'S REENLISTMENT PREDICTION (ROGER) MODEL

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ABSTRACT

The Navy's Selective Reenlistment Bonus Management System (SRBMS) uses a model known as ROGER to identify the SRB-eligible population and to predict the number of SRB takers for the following fiscal year. The Enlisted Bonus Manager uses the ROGER model to determine the SRB plans during the execution year. Over the years, constant changes in the structure of the SRB program have led to increasing levels of predictive error in the ROGER model. Specifically, the ROGER model has routinely under-identified the SRB-eligible population, which, in turn, led to under-predictions in the size of the predicted number of SRB takers and the SRB budget. One of the reasons for the under-predictions is the ROGER model does not account for sailors who acquire an SRB-eligible NEC during the execution year.

The objective of this thesis is to determine whether the predictive errors in the Navy's SRBMS (ROGER) model can be reduced by accounting for new NEC/skill acquisition by sailors each fiscal year. NEC/skill acquisitions are accounted for by incorporating data into the ROGER model from the Naval Education and Training Command (NETC) on annual school enrollments and graduations. This thesis analyzes the impact of adding the NETC skill acquisition data to the ROGER model by analyzing the predicted SRB-eligible population and the predicted number of SRB takers and by assessing the resulting impact on the predicted SRB budget.

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LIST OF ABBREVIATIONS AND ACRONYMS

CDP	Course Data Processing code
CeTARS	Corporate enterprise Training Activity Resource System
CPI	Consumer Price Index
DoD	Department of Defense
EMR	Navy Enlisted Master Record
LOS	Length-of-Service
MPT&E	Manpower, Personnel, Training, and Education
NEC	Naval Enlisted Classification
NETC	Naval Education and Training Command
OPNAVINST	Operational Navy Instruction
SRB	Selective Reenlistment Bonus
SRBMS	Selective Reenlistment Bonus Management System

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I. INTRODUCTION

A. BACKGROUND

The purpose of the Navy's Selective Reenlistment Bonus (SRB) program is to help retain experienced enlisted personnel in critical or undermanned occupational specialties. The SRB program helps retention by using selective financial incentives to focus retention efforts on those Navy Enlisted Classifications (NECs) and ratings that are hard to retain or costly to replace. Using targeted SRBs is more cost-effective than giving across-the-board pay raises to increase retention.

The Deputy Chief of Naval Operations (Manpower, Personnel, Training and Education) (MTP&E) (N1) has overall responsibility for the Navy's SRB program. The SRB program is considered by N1 to be the "primary monetary Force shaping tool to achieve enlisted retention requirements in ratings, Navy Enlisted Classifications (NECs) and skills" (OPNAVINST 1160.8A, 2007). The Navy has been using the Selective Reenlistment Bonus Management System (SRBMS) to manage the SRB program since 1974.

1. History

The Navy's Selective Reenlistment Bonus Management System (SRBMS) uses a model known as ROGER to determine the SRB-eligible population and to predict the number of SRB takers for the following fiscal year. The ROGER model is a Windows-based application created in the mid-1990s to assist the Navy's Compensation and Policy Coordination Division (N130) and the Enlisted Community Managers (BUPERS-32) in determining SRB plans during the execution year.

Over the years, constant changes in the structure of the SRB program have led to increasing levels of predictive error in the ROGER model. Specifically, the ROGER model has routinely under-identified the SRB-eligible

population, which, in turn, leads to under-predictions in the size of the predicted number of SRB takers (Alloway and Stockton, 2008, p.6). Also, the predicted SRB taker population is the main factor used to predict the SRB budget for the future fiscal year, thus SRB program costs also tend to be under-predicted:

> Historically, at least since FY97, the Navy has, more often then not, failed to contain SRB costs within the congressionally appropriated amount. In most years, funds are reprogrammed from within the enlisted personnel budget in order to meet the increased costs of the SRB program (Alloway and Stockton, 2008, p.1).

Previous studies have shown the two main causes of the under-prediction of SRB takers by the ROGER model for a given fiscal year are due to skill acquisition and early reenlistments during the program execution year (Moore, Hogan, and Espinosa, 2003, p.5). In FY00, the ROGER model failed to identify more than one-fifth of the actual SRB takers as being eligible for an SRB. It was determined that 36% of the error between predicted and actual SRB takers was due to new skill (NEC) acquisition in the fiscal year (Espinosa, Hogan, and Moore 2003, p.5). Most of the new NECs are obtained via completion of Department of Defense (DoD) technical schools, while a small number are obtained from on-the-job training (OJT) or civilian certifications. These new NEC acquisitions create hundreds of new SRB-eligible personnel during the execution year who are not identified in the initial SRB taker projections.

B. PURPOSE OF THESIS

The objective of this thesis is to determine whether the predictive errors in the Navy's SRBMS (ROGER) model can be reduced by accounting for new NEC/skill acquisition by sailors during the execution year. NEC/skill acquisitions are accounted for by incorporating data into the ROGER model provided by the Naval Education and Training Command (NETC) on annual school enrollments and graduations. This thesis will analyze the impact of adding the new NETC skill acquisition data to the predicted SRB-eligible population and the predicted number of SRB takers, assessing the resulting impact on the ROGER model's

overall prediction error. Reducing the prediction errors in the ROGER model will allow for the creation of a more realistic SRB budget, which would greatly reduce the need to reprogram funds to cover actual SRB costs.

C. SCOPE AND METHODOLOGY

This thesis will determine the effects of NETC school enrollment and graduation data upon the ROGER model's predictions of the SRB-eligible population and the number of takers. This thesis will compare the differences between the ROGER model's SRB-eligible population and SRB taker population from applying the NETC data vice not using the NETC data. Then, this thesis will compare both sets of results, for each fiscal year, on the actual SRB taker population for the given fiscal year to see if incorporating the NETC data on skill acquisition decreases the prediction error in the ROGER model. In addition, the changes to the SRB budget for each fiscal year will be estimated.

D. ORGANIZATION OF STUDY

The thesis is organized into the following chapters:

Chapter II. Overview of the SRBMS. This chapter gives an overview of the SRBMS to include describing eligibility criteria for an SRB, discussing how the ROGER model works, and presenting information on the performance of the ROGER model from previous studies.

Chapter III. Data and Analytical Methods. This chapter describes the data sources for the thesis, the variables used in the analysis, and the analytical methods in the ROGER model.

Chapter IV. Analysis of the Results. This chapter explains the results obtained from the analysis and shows the impacts on SRB takers and budget projections.

Chapter V. Conclusion and Recommendations. This chapter summarizes the findings from the analysis, states policy recommendations based on the analysis, and provides directions for future research.

II. OVERVIEW OF THE SELECTIVE REENLISMENT BONUS MANAGEMENT SYSTEM (SRBMS)

This chapter provides an overview of the SRBMS. It includes a description of the eligibility criteria for an SRB, a discussion of how the ROGER model works, and a discussion of the predictive accuracy of the ROGER from previous studies.

A. SRB PROGRAM ELIGIBILITY

1. Criteria for Skill Eligibility for an SRB

The Navy's SRB program managers determine whether individual ratings or NECs are eligible for an SRB, based on the following factors:

- Skill or NEC has high training or replacement costs for personnel.
- Skill or NEC is essential skill to the mission of the Navy.
- Skill of NEC has severe under-manning in three or more adjacent year groups in the bonus zone.
- Skill or NEC has severe under-manning as shown by a history of shortages in past years or projected for future years.
- Skill or NEC is relatively arduous or unattractive skill compared to the other ratings/NECs/skills or civilian alternatives.
- The SRB award amount improves retentions enough to justify the cost (OPNAVINST 1160.8A, 2007, p. 2).

2. Individual Sailor Eligibility for an SRB

Individual sailors are determined to be eligible to reenlist for an SRB based upon the following criteria:

- Sailor must be on active duty, except active duty for training, and complete at least 17 continuous months of active service, but not more than 14 years.
- Sailor must be eligible to reenlist or extend for at least three years.

- Sailor has obtained pay grade E-4 or higher, or is an undesignated E-3 striking for a rating.
- Sailor must be qualified for and serving in an SRB-qualified rating or NEC.
- Sailor is not currently receiving entitlement for an SRB, payment of readjustment, severance or separation pay.
- Sailor must serve in the rating/NEC/skill for the period of the reenlistment for which the SRB was awarded unless the member is reassigned to meet the needs of the Navy.
- Sailor must reenlist prior to three months before date of discharge or release from active duty service. Director, MPT&E Policy Division (N13) may prescribe a lesser period as needed to improve manning and retention objectives.
- Sailor must meet any additional criteria prescribed by N13 (OPNAVINST 1160.8A, 2007, p. 2-3).

3. Zone Eligibility Criteria

As previously stated, SRB eligibility is limited to active duty personnel with at least 17 months of continuous, non-training status active duty, but not more than 14 years of service. The period of active duty service is broken down into three eligibility zones:

- Zone A: The service member must have at least 17 months of continuous active military service but not more than six years of service on the reenlistment date.
- Zone B: The service member must have completed at least six but not more than 10 years of active duty service on the reenlistment date.
- Zone C: The service member must have completed at least 10 but not more than 14 years of active duty service on the reenlistment date.

It should also be noted that only one SRB from each zone can be awarded during a career (OPNAVINST 1160.8A, 2007, p. 5).

B. SRB AWARD AMOUNTS

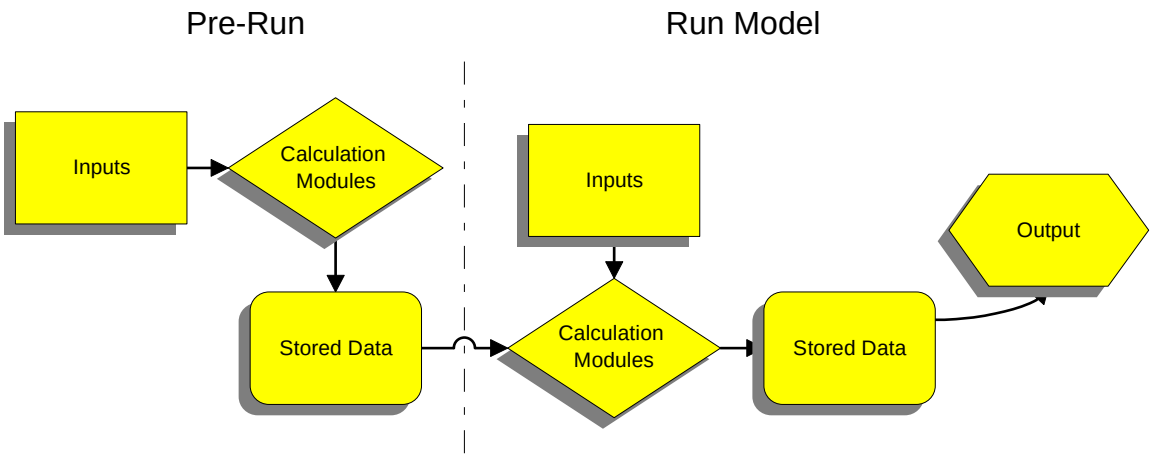
Calculation of the applicable SRB award dollar amount is performed using the following equation:

*SRB Award = (Monthly base pay * Contract length in years * SRB multiple)*

SRB multiples are offered in increments of .5, with a maximum limit of 15. The standard range of multiples is from 0 to 6. As of 30 January 2007, the award ceiling for SRB is $90,000 (OPNAVINST 1160.8A, 2007, p. 11).

C. THE ROGER PREDICTION MODEL

When attempting to estimate a fiscal year reenlistment prediction scenario in the ROGER model, the inputs and calculations are performed in two different phases. These two phases are known as the "Pre-Run" phase and the "Run Model" phase. Figure 1 diagrams the structure and data flow of the ROGER model.



Source: Mackin, 1999, Appendix B, p. 4.

Figure 1. ROGER Primary Components

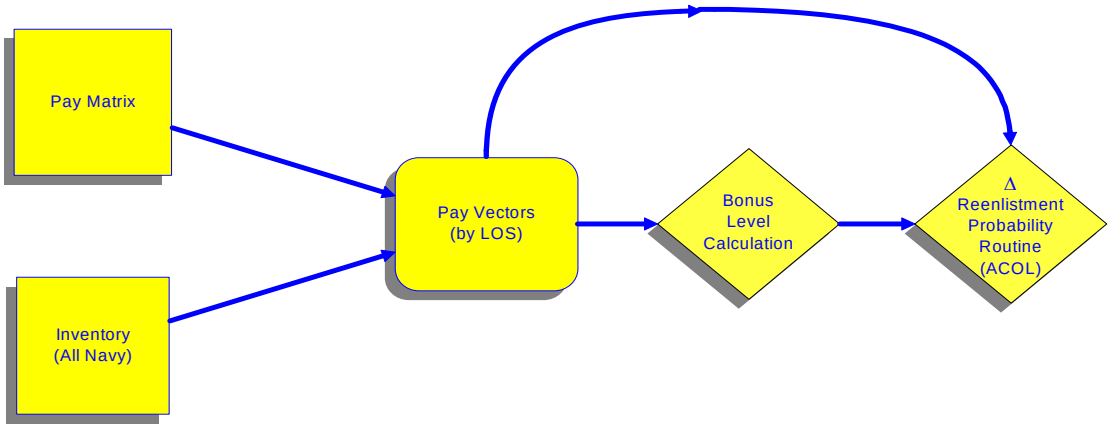
Before a scenario is run, the "Pre-Run" phase is performed to enter multiple primary inputs into the model. These primary inputs include:

- Consumer Price Index (CPI) deflator
- SRB lump sum percentage (currently 50%)
- Pay tables

- All-Navy Inventory data
- Skill modifiers
- Analysis file (contains Navy enlisted inventory information)

The “Pre-Run” phase only needs to be opened if it is the first time running the scenario or if the data must be updated. (Mackin, 1999, Appendix B, p. 4-5)

The pay tables and all-Navy inventory inputs must be entered for the initial baseline year and for the analysis year. Figure 2 shows the relationship between the pay table and all-Navy inventory inputs. The ROGER model condenses the information from the pay tables and the all-Navy inventory file into length-of-service (LOS) groups. The data from the LOS groups is then used during the “bonus level calculation” routine, which makes calculations for the SRB award levels by length of reenlistment (3-6 years), length of service (0-12 years), and multiplier (0-10). The model then converts the pay information into base year dollars, which is added into the initial year’s and analysis year’s ACOL values (Mackin, 1999, Appendix B, p. 5).



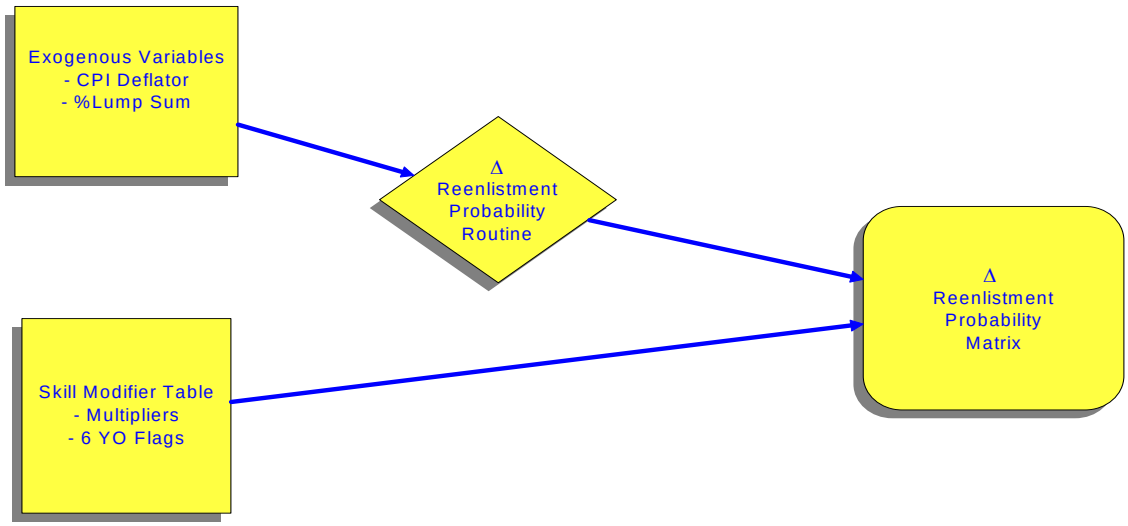
Source: Mackin, 1999, Appendix B, p.5.

Figure 2. Pre-Run Pay and Inventory Inputs

The user must also update additional "exogenous variables" as necessary prior to the Run-Model phase. These variables include:

- Percentage of SRB paid as a lump sum (currently 50%)
- Initial year SRB multipliers are entered in the skill modifier table by skill and zone
- Current Consumer Price Index data, which is used to deflate the pay and bonuses to base-year values (Mackin, 1999, Appendix B, p. 5).

When the exogenous variables are updated, the ROGER model then determines the changes in reenlistment probabilities among all skill and LOS groups, based on changes made to the initial SRB multiplier plan. This new probability data is stored in the "delta reenlistment probability matrix," which allows running of new scenarios without recalculating reenlistment probabilities each time (Mackin, 1999, Appendix B, p. 5). Figure 3 diagrams the flow of the exogenous variables.

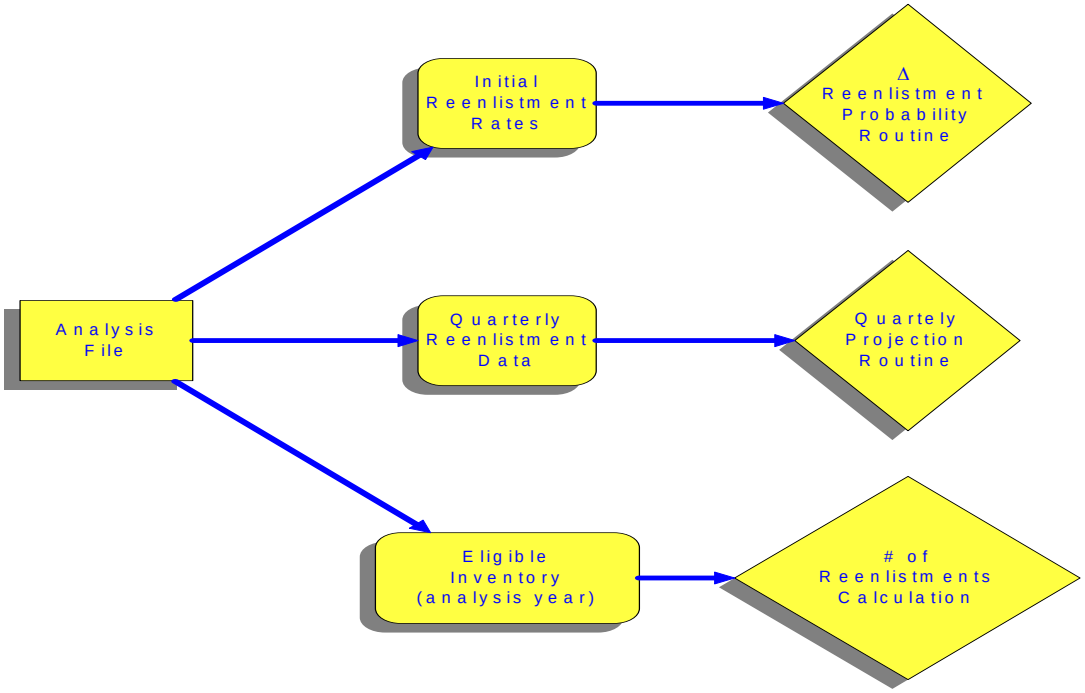


Source: Mackin, 1999, Appendix B, p. 6.

Figure 3. Additional Pre-Run Inputs

In the last portion of the Pre-Run phase, illustrated in Figure 4, the analysis file is used to construct the initial reenlistment rates, identify the inventory of SRB-eligible personnel, and predict quarterly reenlistments. The

"eligible inventory file" is multiplied by the reenlistment probability, from the reenlistment probability matrix, to obtain the predicted reenlistments in a given fiscal year by quarters or for an entire year (Mackin, 1999, Appendix B, p. 6).



Source: Mackin, 1999, Appendix B, p. 6.

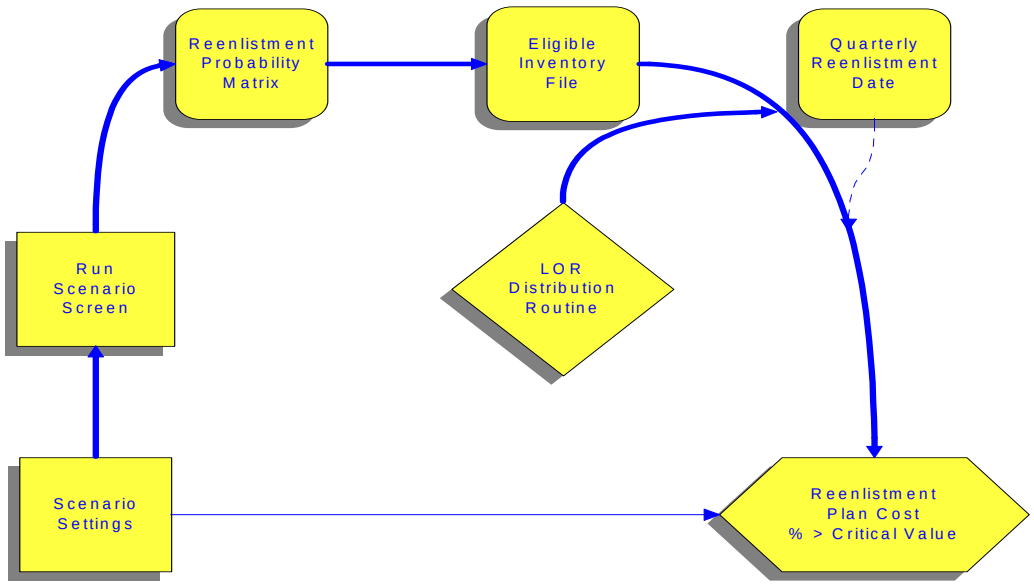
Figure 4. Analysis File Data Generation

Once the Pre-Run phase has been completed, the user starts the "Run" phase by inputting the analysis year information into the "run scenario" and "scenario settings" screens. The user can then enter the planned SRB multipliers for each skill and zone, the award ceilings (currently $90,000) and "fenced" (buffered from alterations in multiplier levels) skill groups. The adjustable scenario settings include:

- the maximum multiplier level change between the base year and analysis year,
- the length of time for which the analysis should be run (one year or one-three quarters)
- the maximum bonus level to be used (Mackin, 1999, Appendix B, p. 7).

As illustrated in Figure 5, reenlistment probabilities associated with the given SRB plan are applied to the eligible inventories that were identified in the "Pre-Run" phase. The model then generates predicted reenlistments (by skill, length of service, length of reenlistment and EAOS), the costs of the SRB plan, and finally a report showing the percentage of takers above the critical value bonus level. The enlisted community managers previously required the creation of the critical value bonus report to determine the number of personnel reenlisting for SRBs above a certain bonus multiplier. This report aided in shaping of the SRB multiplier list for each fiscal year. The results of the ROGER model predictions can be displayed by:

- Bonus plan cost
- Reenlistment rate
- Number of reenlistments (Mackin, 1999, Appendix B, p. 7).



Source: Mackin, 1999, Appendix B, p. 7.

Figure 5. Run Model Structure

D. MODEL ASSESSMENT

1. Prediction History

Alloway and Stockton (2008, p.1) report that, "Historically, at least since FY97, the Navy has, more often then not, failed to contain SRB costs within the congressionally appropriated amount. In most years, funds are reprogrammed from within the enlisted personnel budget in order to meet the increased costs of the SRB program." The requested and actual SRB program expenditures are shown in Table 1 and Figure 6.

Table 1 shows the differences between the requested SRB budget per fiscal year (column 1) and the actual expenditures (column 2). The missed percentages in column 4 are based on comparison of the total amount the budget missed as a ratio of the actual SRB program expenditure for each fiscal year. Table 1 shows the statistics numerically while Figure 6 displays the requested and actual SRB expenditures (in millions of dollars) each year.

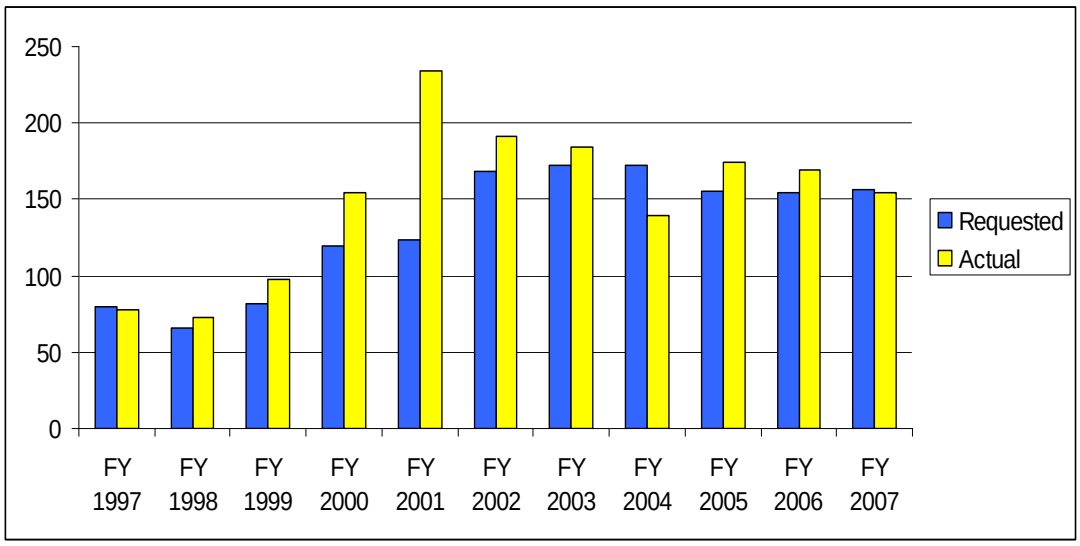
Table 1. Navy's Selective Reenlistment Bonus Program's Requested and Actual Expenditures for FY97-07

(In $ Millions)

	Requested	Actual	Actual - Requested	Missed (%)
FY 1997	$80	$78	$-2	2.6%
FY 1998	66	73	7	9.6%
FY 1999	82	98	16	16.3%
FY 2000	120	154	34	22.1%
FY 2001	124	234	110	47.0%
FY 2002	168	191	23	12.0%
FY 2003	172	184	12	6.5%
FY 2004	172	139	33	23.7%
FY 2005	155	174	19	10.9%
FY 2006	154	169	15	8.9%
FY 2007	176	154*	22	14.3%

Source: Navy budget justification books FY97-09

* FY2007 actual expenditures were as of Feb 08 and, therefore, are incomplete



Source: Navy budget justification books FY97-09

Figure 6. Navy's Selective Reenlistment Bonus Program's Requested and Actual Expenditures for FY97-07 (In $ Millions)

2. Lewin Group Study

In 2003, the Lewin Group (Moore, Hogan and Espinosa, 2003) was asked by the Navy to perform an independent testing and analysis of the accuracy of the SRBMS. The Lewin Group's analysis consisted of testing the key components of the model as well as the model as a whole. For their analysis, the Lewin Group looked specifically at predictions of several outcomes for FY00:

- The SRB-eligible population
- The number of personnel who reenlist for an SRB (SRB takers)
- The average length of reenlistment among the SRB takers

a. SRB-eligible Population

According to the Lewin Group study, the ROGER model under-predicts the actual size of the SRB-eligible population. For FY00, over one-fifth of the 15,048 actual SRB takers were not identified as SRB-eligible. The model predicted most accurately in Zone A, with 82% of the SRB takers predicted to be

eligible, while in Zones B and C only 70% of the SRB takers were identified as eligible. The reasons for the under-identification of SRB-eligibles was ascertained to be caused by two primary factors: new skill acquisition by sailors during the fiscal year, and early reenlistments (Moore, et al., 2003, p.11).

For FY00, 36% of the 3,402 actual takers who were not identified as being SRB-eligible were mis-identified because they obtained a new SRB-eligible skill during the planning fiscal year. Skill acquisition caused 68% of the error in Zone A, 24% of the error in Zone B and 8% of the error in Zone C. Skill acquisition had the greatest impact upon predictions for the HM rating, with up to 93.5% of missing eligibles in the HM rating being caused by new skill acquisition during the fiscal year (Moore, et al., 2003, p.14-15).

The second factor affecting identification of the number of SRB-eligibles is the number of sailors who reenlist for an SRB prior to the time they are in the normal reenlistment eligibility window. The ROGER model only selects as SRB-eligible those personnel who are within 13 months of their EAOS and who hold an SRB granting NEC. The Lewin Group identified three main reasons for early reenlistment for an SRB outside of the normal eligibility window:

1) Permanent Change of Station (PCS) orders

2) Sailors holding Nuclear NECs

3) Sailors holding submariner ratings/skills

All three factors allow personnel to reenlist for an SRB prior to the normal reenlistment eligibility window, which makes it impossible for the ROGER model to account for these personnel in each fiscal years pool of SRB-eligible personnel. While these early reenlistment reasons can help with identifying eligibles, they still accounted for only about one-half (47%) of the 2,215 personnel who reenlisted early (Moore, et al., 2003, p.16).

b. SRB Takers

According to the Lewin Group study, the ROGER model under-predicts actual reenlistments in all of the SRB zones. The Lewin Group realized the error from the eligibles pool would have an effect upon SRB taker predictions, so they decided to remove from their analysis file any actual takers who were not identified as eligible (Moore, et al., 2003, p. 18-19).

Table 2 displays the differences between the predicted and actual SRB takers for each zone in FY00. For FY00, the average difference between the predicted and actual SRB takers was 14.5%. Zone B had a prediction error of 11.9%, while Zone C had an error of 22%.

Table 2. Actual and Predicted SRB Takers, by Zone, for FY00

Zones	(1) Predicted	(2) Actual	(3) Difference =(1-2)	(4) Percent Difference (%)
Zone A	6,489	7,493	1,004	14.4%
Zone B	2,584	2,911	327	11.9%
Zone C	996	1,242	246	22.0%
Total	10,069	11,646	1,581	14.5%

Note: The percentage difference uses the average of actual and predicted values as its base: =(1-2)/((1+2)/2) Source: Moore, et al., 2003, p. 19

Table 3 shows the Lewin Group's predicted and actual reenlistments broken down by zones and occupation groups for FY00. The table shows the disparity in predictions across the broad occupation groups and zones. Some occupations, such as Non-electronic maintenance, Aviation maintenance, and Logistics, have over-predictions in certain zones, while other occupations have severe under-predictions. As shown in Table 3, reenlistments for Electronic maintenance occupation group were under-predicted by 528 personnel in FY00 in all three zones.

Table 4 shows the breakdown of under-predicted, over-predicted, and exactly predicted reenlistments by zone and skill groups for FY00.

Table 3. Predicted and Actual Reenlistments by Zone and Occupation Group, for FY00

Occupation Group	Zone A			Zone B			Zone C		
	Predicted	Actual	%Diff	Predicted	Actual	%Diff	Predicted	Actual	%Diff
Non-electronic maintenance	1,704	1,867	9.1%	340	316	-7.3%	191	173	-9.9%
Electronic maintenance	1,776	2,304	25.9%	584	699	17.9%	355	361	1.7%
Aviation maintenance	643	570	-12.0%	201	147	-31.0%	1	9	160.0%
Ship/Aviation support	1,276	1,362	6.5%	542	686	23.5%	42	150	112.5%
Health care	122	141	14.4%	240	242	0.8%	28	34	19.4%
Logistics	208	263	23.4%	103	79	-26.4%	-	-	NA
Construction	253	353	33.0%	207	266	24.9%	1	1	0.0%
Cryptology	361	395	9.0%	161	188	15.5%	60	104	53.7%
Admin, media and other	146	238	47.9%	206	288	33.2%	318	410	25.3%

Note: The percentage differences use the average of actual and predicted values as its base
Source: Moore, et al., 2003, p. 21

Table 4. Number of SRB Skill Groups Contributing to Prediction Error

	Zone A	Zone B	Zone C
Under-predict reenlistments	106	96	47
Over-predict reenlistments	54	67	18
Exactly predict reenlistments	91	79	36
Total	251	242	101

Source: Moore, et al., 2003, p. 22

3. Alloway and Stockton Study (2008)

In FY04, changes were made to the algorithm in the ROGER model that allowed it to look at all of the NECs that each individual holds when determining eligibility for an SRB. When multiple NECs are present, the model now selects the NEC that offers the largest bonus. Prior to FY04, the ROGER model only looked at the Primary NEC (PNEC) of each individual.

Alloway and Stockton performed an analysis on the updated ROGER model to see how the changes to the algorithm affected model predictions. Unlike the Lewin Group study, Alloway and Stockton used multiple fiscal years (FY04-07) in their study to try to account for any relevant trends (Alloway and Stockton, 2008, p. 57).

In their study, Alloway and Stockton found that the model did not correctly identify between 21% and 27.9% of the actual takers as eligible during the FY04-07 period. While the total number of under-predictions varied across year and zone, the rankings of percentage missed by zone stayed consistent, with Zone A having the lowest percentage of takers who were not predicted as eligible, and Zone C having the highest percentage of takers who were not predicted as eligible (Alloway, et al., 2008, p. 61-64). Tables 5 through 8 show the differences between actual takers and the predicted eligibles for each fiscal year during the FY04-FY07 period.

Table 5. Alloway and Stockton, FY04 Snapshot of Number of Eligibles, Takers, Mis-Predicted Takers, and Percentage Error

	(1) Total SRB Takers	(2) Identified SRB Reenlisters	(3) Missed SRB Reenlisters =(1-2)	(4) Percent Error
Zone A	7,672	6,133	1,539	20.1%
Zone B	4,240	3,088	1,152	27.2%
Zone C	1,742	985	757	43.5%
Total	13,654	10,206	3,448	25.3%

Source: Alloway and Stockton, 2008, p. 6

Table 6. Alloway and Stockton, FY05 Snapshot of Number of Eligibles, Takers, Mis-Predicted Takers, and Percentage Error

	(1) Total SRB Takers	(2) Identified SRB Reenlisters	(3) Missed SRB Reenlisters =(1-2)	(4) Percent Error
Zone A	10,194	8,533	1,661	16.3%
Zone B	4,589	3,255	1,334	29.1%
Zone C	2,190	1,128	1,062	48.5%
Total	16,973	12,916	4,057	23.9%

Source: Alloway and Stockton, 2008, p.62

Table 7. Alloway and Stockton, FY06 Snapshot of Number of Eligibles, Takers, Mis-Predicted Takers, and Percentage Error

	(1) Total SRB Takers	(2) Identified SRB Reenlisters	(3) Missed SRB Reenlisters =(1-2)	(4) Percent Error
Zone A	9,674	8,530	1,144	11.8%
Zone B	4,898	3,555	1,343	27.4%
Zone C	2,346	1,304	1,042	44.4%
Total	16,918	13,389	3,529	20.9%

Source: Alloway and Stockton, 2008, p.63

Table 8. Alloway and Stockton, FY07 Snapshot of Number of Eligibles, Takers, Mis-Predicted Takers, and Percentage Error

	(1) Total SRB Takers	(2) Identified SRB Reenlisters	(3) Missed SRB Reenlisters =(1-2)	(4) Percent Error
Zone A	6,385	5,443	942	14.8%
Zone B	4,622	3,054	1,568	33.9%
Zone C	2,407	1,184	1,223	50.8%
Total	13,414	9,681	3,733	27.8%

Source: Alloway and Stockton, 2008, p. 64

Alloway and Stockton also performed an analysis to determine the number of takers who were not originally identified as eligible but who had obtained an SRB-eligible skill or NEC during the planning fiscal year. Alloway and Stockton focused on the FY07 data for this analysis. The analysis showed that 12% of the non-identified eligibles were due to new skill acquisition during the fiscal year. This was a big drop from the 25% identified by the Lewin Group study in FY00. Alloway and Stockton attributed the difference between FY00 and FY07 to the changes made to the ROGER model's algorithm in FY04 and to the unique eligible pools for the given fiscal years. In addition, 86% of the missing takers were outside the eligibility window. Sailors are within the reenlistment eligibility window if they are within 13 months of their end of obligated service (EAOS). Of those outside the eligibility window, 13% were in Zone A and 73% were in Zone B or C (Alloway and Stockton, 2008, p.65-66).

While the overall analysis statistics explaining the ROGER model prediction errors varied between the Lewin Group study and the Alloway and Stockton study, Alloway and Stockton still identified the two main reasons for mis-identification of takers as:

- sailors have gained a new NEC during the fiscal year, and
- reenlistments are outside of the eligibility window (i.e., reenlistment due to PCS orders or NUC NECs)

Alloway and Stockton also attributed a number of other potential reasons for the poor projections of the SRB takers, to include:

- Improper establishment of baseline reenlistment rates
- Inaccurate pay elasticities
- Poor grouping of Navy skill groups (Ratings/NECS)
- Changes in civilian unemployment rates
- Missing or deficient data
- Unforeseen events affecting behavior (e.g., increased deployments to tax-free areas) (Alloway and Stockton, 2008, p.77).

E. CHAPTER SUMMARY

The ROGER model is designed to run in two phases: pre-run and run. During the pre-run phase, users enter the primary data inputs and use the model to construct the initial reenlistment rates and identify the number of SRB-eligible sailors. Once the pre-run phase is complete, the run phase is started and the user inputs the SRB multipliers, length of time the analysis should be run, and the maximum bonus level. The scenario is then set to run and the ROGER model projects the number of reenlistments by NEC and the cost of the SRB bonus plan.

Multiple studies over recent years have shown that, on average, the ROGER model fails to correctly identify approximately 25% of the actual SRB takers as SRB-eligible. This was first determined by the Lewin Group study in 2003 and then reconfirmed by the Alloway and Stockton study in 2008. Both of these studies determined that the main factors causing the under-identification of eligibles were: 1) sailors gaining new SRB-eligible skills/NECs during the fiscal year, and 2) sailors reenlisting outside of the normal eligibility window.

While there are multiple factors causing under-identification of eligibles in the ROGER model, this thesis will look specifically at the under-identification of eligibles due to sailor acquisition of new SRB-eligible skills/NECs during the fiscal year. This thesis will determine whether the predictive errors in the Navy's SRBMS model can be reduced by accounting for sailor NEC/skill acquisition each fiscal year, incorporating Naval Education and Training Command (NETC) annual school enrollment and graduation data into the ROGER model.

III. DATA AND METHODOLOGY

This chapter describes the data sources used in this thesis and discusses the variables used in the analysis and the methods of analysis used to determine the effects of incorporating the execution-year school enrollment data into the ROGER model.

A. DATA

1. Data Sources

The source of enlisted school enrollment and graduation data for this analysis was the Navy's Corporate enterprise Training Activity Resource System (CeTARS) database, which is controlled by Naval Education and Training Command (NETC). CeTARS is the Navy's database for training course description and statistical information on all formal training courses. OPNAVINST 1510.10B requires information from every formal course of instruction conducted in the Navy to be reported to CeTARS. Formal training courses that are reported to CeTARS include accession training, initial and general skill training, specialized skill training, and career development training that focuses on training for a designated billet or specialty (OPNAVINST 1510.10B, 2005). The NETC Business Operations Branch (N63) is the designated CeTARS program manager. All requests for CeTARS data are routed through N63.

The ROGER model uses a snapshot of the Navy Enlisted Master Record (EMR) to perform its initial determination of the SRB-eligible population. The SAG Corporation provided up-to-date EMR snapshots along with a copy of the ROGER model executable files.

2. Data Extraction and Compilation

For this analysis, the planned enrollment and graduation data was extracted and compiled for FY04 to FY08. To extract the specific NEC enrollment and graduation data from the CeTARS database, the Course Data Processing (CDP) codes were used. These codes are associated with each NEC in the Manual of Navy Enlisted Manpower and Personnel Classifications and Occupational Standards, NAVPERS 18068F. The CDP is the code assigned to uniquely identify each course of instruction and its physical location. If the same course is taught at different physical locations, it has different CDP codes.

Some of the CDPs have NECs associated with them in the CeTARS data files, but analysis of the CeTARS database files showed that many of the CDPs that have NECs associated with them in NAVPERS 18068F did not have any NEC information assigned to them in the CeTARS data files. This random assignment of NECs to the corresponding CDPs in the CeTARS database prevented easy compilation of the NEC data. The total graduates for each NEC had to be compiled by manually totaling the graduates for all of the CDPs that award each NEC.

B. METHODOLOGY

1. Data Input

While the compiled dataset contained planned enrollment and graduation data on 116 NECs for each fiscal year, only 16 of these NECs from FY04 to FY08 were used in the analysis. These NECs were used to allow for an initial analysis of incorporating the new CeTARS data into the ROGER model, but to avoid the heavy time burden required to manually input the entire data set into the EMR snapshots. To choose which NECs were to be used in this analysis, the actual SRB taker file for FY07 was analyzed; those NECs that had at least 50 actual SRB takers during the fiscal year, or that historically had poor prediction performance, were chosen for the analysis. The NECs with more than 50 actual

SRB takers were chosen to reduce the number of overstated effects due to small changes in the predicted SRB takers from incorporating the CeTARS data. Some of the NECs have small amounts (less than 10) of actual takers each fiscal year, so using these NECs would show dramatic effects from very small increases in the number of predicted takers. The NECs for the HM rating were included because they historically have had poor prediction performance in the ROGER model. The NECs chosen for the analysis were also spread across multiple occupation groups. Table 9 lists the NECs used in the analysis along with their title and associated community. The table shows that the NECs are spread across the Surface, Intel, Specwar, Medical, and Cryptology communities.

Table 9. List of NECs Used for Analysis

NEC	SRB DESCRIPTOR	TITLE	COMMUNITY
2735	IT-SYS ADMIN	Information Systems Administrator	Surface
2780	IT-NET SEC	Network Security Vulnerability Technician	Surface
2781	IT-ADV NET	Advanced Network Analyst	Surface
3910	IS-IMAGE	Naval Imagery Interpreter	Intel
3924	IS-NTCS	Operational Intelligence (OPINTEL) Analyst	Intel
5326	SO-SEAL	Special Warfare Operator (SEAL)	SpecWar
5343	ND-SECOND	Diver Second Class	SpecWar
5352	SB-SWCC AD	Special Warfare Combatant Crewman (SWCC) Advanced	SpecWar
8425	HM-SW IDC	Surface Force Independent Duty Corpsman	Medical
8432	HM-PREV	Preventive Medicine Technician	Medical
8452	HM-XRAY AD	Advanced X-ray Technician	Medical
8482	HM-PHARM	Pharmacy Technician	Medical
8483	HM-SURG	Surgical Technologist	Medical
8506	HM-MED TEC	Medical Laboratory Technician Advanced	Medical
9138	CTR-A&R	Journeyman Analysis and Reporting Specialist	Crypto
9147	CTR-INTSIG	Intermediate Signals Analyst	Crypto

Source: Author created

The data was incorporated into the EMR snapshot by assigning an NEC to an individual that met the requirements for the NEC (rank, rating, LOS, prerequisite NECs) but did not already have the NEC in the EMR snapshot. The

graduates for each fiscal year were assigned across the paygrades of each NEC based on the ratios of the paygrades for that NEC in the list of actual takers for the given fiscal year.

The CeTARS data was incorporated into the EMR snapshot using the following data compilations:

- The actual number of graduates (average) for FY06 thru FY08 in each NEC
- The planned graduates for FY07 and FY08, for each NEC, calculated via the following formula: ***(Previous 2-Yr Actual Grads / Previous 2-Yr Planned Enroll) x Current FY Planned Enrollment***

This formula determines the ratio of graduates to planned enrollment over the two previous years, and then multiplies this ratio by the given fiscal year's planned enrollment to determine the number of planned graduates for a given fiscal year. The purpose of using the number of planned graduates is to try to account for changes in the total actual graduates in a fiscal year due to fluctuations in the planned enrollment of each NEC. The fiscal year enrollment plans tend to have erratic variations across the NECs and skill groups from year to year, so it is hypothesized that using the actual planned number of graduates in the modified databases should work better than just using the graduate averages for the previous two fiscal years.

The actual graduate average data is included in the ROGER model to determine their impact on the ROGER model's prediction of SRB takers. The prediction results using the two modified databases are compared to the baseline predictions as well as to each other to see if there is a notable difference in the predictions from using the average number of actual graduates or the calculated number of planned graduates.

Table 10 shows the planned enrollment numbers by NEC for FY 2006 to FY 2008. As one can see, the enrollment plans for some NECs are relatively constant over time, while others have huge increases or decreases from year to

year. Most of these fluctuations are due to the enlisted community managers adjusting school quotas to try to manage the size and rank structure of their given communities.

Table 10. Planned Enrollments by NEC and Fiscal Year

NEC	Descriptor	Community	FY2006	FY2007	FY2008
2735b	IT-SYS AD	Surface	1066	1178	1196
2780b	IT-NET SEC	Surface	532	634	474
2781	IT-ADV NET	Surface	216	308	338
3910	IS-IMAGE	Intel	510	153	153
3924	IS-NTCS	Intel	421	507	397
5326	SO-SEAL	SpecWar	250	287	296
5343	ND-SECOND	SpecWar	200	232	245
5352	SB-SWCC AD	SpecWar	240	240	131
8425	HM-SW IDC	Medical	313	260	239
8432	HM-PREV	Medical	160	161	132
8452	HM-XRAY AD	Medical	134	177	158
8482	HM-PHARM	Medical	108	158	153
8483	HM-SURG	Medical	286	310	297
8506	HM-MED TEC	Medical	261	247	260
9138	CTR-A&R	Crypto	130	173	177
9147	CTR-INTSIG	Crypto	214	239	217

Source: Author created from CeTARS database

Table 11 shows the calculated planned number of graduates by NEC for fiscal years 2007 and 2008. These are the numbers used to assign new NECs to individuals in the modified databases using NEC calculated planned graduates. Some of the calculated planned graduate numbers stay relatively consistent across the NEC from year-to-year, while others fluctuate by a few hundred.

Table 11. Calculated Number of Planned Graduates by NEC, FY07-FY08

NEC	Descriptor	COMMUNITY	Calculated Planned Graduates FY2007	Calculated Planned Graduates FY2008
2735b	IT-SYS AD	Surface	767	761
2780b	IT-NET SEC	Surface	561	334
2781	IT-ADV NET	Surface	274	236
3910	IS-IMAGE	Intel	47	74
3924	IS-NTCS	Intel	306	206
5326	SO-SEAL	SpecWar	174	176
5343	ND-SECOND	SpecWar	85	127
5352	SB-SWCC AD	SpecWar	35	42
8425	HM-SW IDC	Medical	150	168
8432	HM-PREV	Medical	114	103
8452	HM-XRAY AD	Medical	127	125
8482	HM-PHARM	Medical	83	76
8483	HM-SURG	Medical	214	209
8506	HM-MED TEC	Medical	156	182
9138	CTR-A&R	Crypto	124	122
9147	CTR-INTSIG	Crypto	159	144

Source: Author created from CeTARS database

Table 12 shows the prior two-year average number of graduates by NEC for fiscal years 2006 through 2008. These are the numbers used to assign new NECs to individuals in the modified databases based on the average number of graduates. As with the calculated planned graduates, some of the average graduate numbers stay relatively consistent across years, while others go up or down by a couple hundred. Again, most of these fluctuations are due to the enlisted community managers adjusting school quotas to try to manage the size and rank structure of their given communities.

Table 12. Prior Two-year Average Number of Graduates by NEC, FY06-FY08

NEC	Descriptor	FY06 Prior Two-year Average Graduates	FY07 Prior Two-year Average Graduates	FY08 Prior Two-year Average Graduates
2735b	IT-SYS AD	647	751	381
2780b	IT-NET SEC	381	456	167
2781	IT-ADV NET	190	224	118
3910	IS-IMAGE	177	105	37
3924	IS-NTCS	246	267	103
5326	SO-SEAL	191	171	88
5343	ND-SECOND	123	118	64
5352	SB-SWCC AD	107	77	21
8425	HM-SW IDC	182	186	84
8432	HM-PREV	116	126	52
8452	HM-XRAY AD	179	139	63
8482	HM-PHARM	72	79	38
8483	HM-SURG	205	218	105
8506	HM-MED TEC	180	174	91
9138	CTR-A&R	106	120	61
9147	CTR-INTSIG	156	159	72

Source: Author created from CeTARS database

2. Analysis Methods

The analysis portion of this thesis focuses on comparing the differences in outputs from the ROGER model while using the unmodified EMR snapshot versus using the EMR snapshot modified with the CeTARS NEC enrollment data. From here on, the output from using the unmodified EMR snapshot in the ROGER model is referred to as the “baseline” output while the output from using the EMR snapshot incorporated with NETC CeTARS data is referred to as the “modified” output.

For this analysis, the ROGER model prediction outputs from using the FY06 to FY08 EMR snapshots are analyzed using the following five focus points:

- First, the baseline eligibles pool created from the unmodified EMR snapshot is compared to the eligibles pool created from the modified EMR snapshot to see how the newly assigned NECs affect the predicted number of eligibles

- Second, the baseline predicted number of SRB takers is compared to the modified predicted SRB takers per fiscal year to determine the effect of the modified databases on the number of predicted takers
- Third, the baseline and modified SRB taker predictions are compared to the actual number of SRB takers per fiscal year to see if the modified EMR snapshot reduced the error between the predicted and actual number of SRB takers
- Fourth, the impact of the modified databases on the predicted SRB budget is analyzed
- Fifth, the modified databases effects upon the number of predicted takers in ROGER is compared to the current practice of increasing the ROGER model taker predictions by a certain percentage

The results for the five focus points are explained in Chapter IV.

IV. ANALYSIS

This chapter will display and discuss the results of the analysis performed on the ROGER model outputs using the baseline database and the databases modified with the CeTARS graduate data. The analysis will include presentation and discussion of the eligibles pools, a comparison of the number of predicted and actual SRB-takers, the budget effects from using the modified databases, and a discussion of other options for reducing the mis-predicted takers.

A. ELIGIBLES ANALYSIS

The first output created by the ROGER model is the pool of SRB-eligible personnel created by analyzing the Enlisted Master Record (EMR) snapshot. This analysis will compare all of the eligible pools that were created using the baseline and modified databases.

1. Comparison of Eligibles Output

Table 13 and Table 14 compare the total “baseline” eligibles output with the eligibles output created from using the “modified” databases. As the data shows, incorporating the previous two-year average graduate data into the database increased the number of eligibles by 25%–27% in Table 13. Using the calculated planned graduate data increased the number of eligibles by 26%–27% in Table 14. The changes in eligibles by individual NEC are shown in Tables 15 through 17.

Table 13. Comparison of Predicted Number of Eligibles Using Modified Average Graduates to Baseline EMR

FY	Baseline Eligibles	Eligibles Using Average Graduates	Difference	Percentage Increase in Eligibles
2006	2137	2721	584	27.3 %
2007	2426	3036	610	25.1
2008	2603	3291	688	26.4

Source: Author created from ROGER model output

Table 14. Comparison of Predicted Number of Eligibles Using Modified Planned Graduates to Baseline EMR

FY	Baseline Eligibles	Eligibles Using Planned Graduates	Difference	Percentage Increase in Eligibles
2007	2426	3088	662	27.3 %
2008	2603	3299	696	26.7

Source: Author created from ROGER model output

Tables 15-17 show the effects of using the "modified" database on the predicted number of eligibles, by NEC, for FY06 to FY08. The data indicates wide variations in the effects of assigning the new NECs into the modified databases. Some NECs had large percentage increases in the predicted number of eligibles, while others had little to no change. However, the percentage increases are often large because they are calculated on a very small base. The percentage increase in the number of eligibles ranged from 0 to 555%, with 25% of the NECs having increases of the number of eligibles of less than 10%, 43% of the NECs having eligibles increases of less than 30%, and 76% of the NECs having eligibles increases of less than 50%. NEC 8425 is a noticeable outlier because the percentage increase averaged around 500%. This large percentage increase was primarily due to the low baseline predictions

of 8 to 12 predicted takers. While the percentage increase in eligibles was high for some NECs, none of the NECs had large increases in their number of eligibles, with the range being 0 to 86.

Table 15. Comparison of Number of Eligibles by NEC Using Modified Average Graduates to Baseline EMR, FY06

NEC	Descriptor	FY06 Baseline Eligibles	Eligibles Increase Using Average Graduates	Percentage Increase In Eligibles
2735b	IT-SYS AD	319	34	10.7 %
2780b	IT-NET SEC	89	37	41.6
2781	IT-ADV NET	63	26	41.3
3910	IS-IMAGE	68	27	39.7
3924	IS-NTCS	98	37	37.8
5326	SO-SEAL	244	6	2.5
5343	ND-SECOND	70	1	1.4
5352	SB-SWCC AD	91	0	0.0
8425	HM-SW IDC	8	43	537.5
8432	HM-PREV	105	42	40.0
8452	HM-XRAY AD	58	79	136.2
8482	HM-PHARM	249	27	10.8
8483	HM-SURG	327	70	21.4
8506	HM-MED TEC	206	62	30.1
9138	CTR-A&R	68	15	22.1
9147	CTR-INTSIG	74	78	105.4

Source: Author Created from ROGER model output

Table 16. Comparison of Number of Eligibles by NEC Using Modified Databases to Baseline EMR, FY07

NEC	Descriptor	FY07 Baseline Eligibles	Eligibles Increase Using Average Graduates	Percent Increase Using Average Graduates	Eligibles Increase Using Planned Graduates	Percent Increase Using Planned Graduates
2735	IT-SYS AD	419	37	8.8 %	25	6.0 %
2780	IT-NET SEC	148	45	30.4	72	48.6
2781	IT-ADV NET	64	32	50.0	41	64.1
3910	IS-IMAGE	61	29	47.5	7	11.5
3924	IS-NTCS	110	43	39.1	59	53.6
5326	SO-SEAL	267	11	4.1	11	4.1
5343	ND-SECOND	40	1	2.5	1	2.5
5352	SB-SWCC AD	80	4	5.0	3	3.8
8425	HM-SW IDC	11	58	527.3	61	554.5
8432	HM-PREV	134	38	28.4	45	33.6
8452	HM-XRAY AD	41	67	163.4	73	178.0
8482	HM-PHARM	235	29	12.3	31	13.2
8483	HM-SURG	392	75	19.1	86	21.9
8506	HM-MED TEC	236	61	25.8	61	25.8
9138	CTR-A&R	84	14	16.7	19	22.6
9147	CTR-INTSIG	104	66	63.5	67	64.4

Source: Author Created from ROGER model output

Table 17. Comparison of Number of Eligibles by NEC Using Modified Databases to Baseline EMR, FY08

NEC	Descriptor	FY08 Baseline Eligibles	Eligibles Increase Using Average Graduates	Percent Increase Using Average Graduates	Eligibles Increase Using Planned Graduates	Percent Increase Using Planned Graduates
2735	IT-SYS AD	500	43	8.6 %	65	13.0 %
2780	IT-NET SEC	138	53	38.4	38	27.5
2781	IT-ADV NET	76	44	57.9	54	71.1
3910	IS-IMAGE	67	18	26.9	11	16.4
3924	IS-NTCS	125	23	18.4	19	15.2
5326	SO-SEAL	291	11	3.8	11	3.8
5343	ND-SECOND	89	22	24.7	35	39.3
5352	SB-SWCC AD	129	2	1.6	0	0.0
8425	HM-SW IDC	12	63	525.0	57	475.0
8432	HM-PREV	111	55	49.5	53	47.7
8452	HM-XRAY AD	36	88	244.4	73	202.8
8482	HM-PHARM	208	27	13.0	29	13.9
8483	HM-SURG	376	78	20.7	82	21.8
8506	HM-MED TEC	248	74	29.8	77	31.0
9138	CTR-A&R	81	26	32.1	33	40.7
9147	CTR-INTSIG	116	61	52.6	59	50.9

Source: Author Created from ROGER model output

2. Comparison of NEC Input to SRB Eligibility Selection

While it is important to know the change in the overall number of SRB eligibles, comparing the increase in eligibles to the number of NECs assigned in the database is also important to understand the total effects of incorporating the graduate data. Tables 18 and 19 show the total number of personnel assigned an NEC in the modified databases and the percentage of those personnel having a newly assigned NEC that were selected as eligible by the ROGER model. As seen in Tables 18 and 19, there is a large difference between the number of personnel assigned a new NEC in the modified databases and the ROGER model's eligibility outputs using those modified databases. One example is FY06

in Table 15, where 2,895 new NECs were assigned, but the ROGER model selected only 584 of these personnel as eligible in Table 18, which was roughly 20% of the new NECs assigned.

One of the reasons for the difference between the actual number of NECs assigned and the increase in the number of eligibles in the ROGER model is that when the databases were created the NECs were assigned randomly across the database to those personnel who met the minimum requirements for the NEC. The minimum requirements for assigning an NEC in the databases were set as the requirements for obtaining the NEC in NAVPERS 18068F. These requirements were specific to rating, rank and time in service.

For the ROGER model to select all of the new NEC-assigned personnel as SRB-eligible, the NECs would have had to be assigned only to those personnel who were within the reenlistment window of 13 months from their EAOS. Since there have been no previous studies to determine the rate of personnel obtaining an NEC and reenlisting in the same year, it was believed, by members of the SAG Corporation as well as the author, that randomly assigning the NECs across the pool of individuals who meet NEC minimum requirements would be more realistic. The number of previous two-year average actual graduates and calculated planned graduates in any given fiscal year was very similar to the number of baseline eligibles, so it is believed that setting all of the graduates as eligible in the database would have doubled the number of eligibles and most likely skewed the analysis data to the high side. Because the actual percentage of personnel who obtain an NEC and reenlist for an SRB in the same fiscal year is not known, the NECs were assigned randomly across the databases instead of specifically being assigned to only those who would be eligible.

Table 18. Percentage of Personnel Assigned an NEC that were Selected as Eligible in ROGER (Using Average Number of Graduates)

FY	Difference	New NEC Assigned Using Average Graduates	Total Percentage of New NEC Selected as Eligible in ROGER
2006	584	2895	20.2%
2007	610	3352	18.2
2008	688	3216	21.4

Source: Author Created from ROGER model output

Table 19. Percentage of Personnel Assigned an NEC that were Selected as Eligible in ROGER (Using Planned Number of Graduates)

FY	Difference	New NEC Assigned Using Planned Graduates	Total Percentage of New NEC Selected as Eligible in ROGER
2007	662	3376	19.6%
2008	696	3085	22.6

Source: Author Created from ROGER model output

Table 20 displays the percentage of new NEC holders selected as eligible in ROGER using the modified databases. Table 20 shows that the percentage of new NEC holders selected as eligible varied greatly across NECs. The percentage of new NEC holders who were selected as eligible ranged from 0 to 71%, with the averages for the fiscal years ranging from 20.8%-27%. This variation is most likely due to differences in the number of personnel to which the new NECs were assigned. Certain NECs are assigned to multiple ratings, while others are assigned to only one rating or have strict prerequisites for obtaining the NEC. An example of this is NEC 8425 HM-SW IDC and NEC 5351 SB-SWCC IN. NEC 8425 only has the requirement of being an HM in pay-grade E5 to E9, where NEC 5351 has multiple requirements to obtain the NEC. Having more restrictions for the NEC would greatly reduce the number of personnel who are available in a given year group for reenlistment.

Table 20. New NEC Holders Selected as Eligible in ROGER Model (In Percent)

NEC	Descriptor	FY06 Average Graduates	FY2007 Average Graduates	FY07 Planned Graduates	FY08 Average Graduates	FY08 Planned Graduates	Average Across NEC
2735	IT-SYS AD	5.96 %	5.71 %	3.26 %	6.02 %	8.54 %	5.9 %
2780	IT-NET SEC	10.12	10.55	12.83	12.91	11.38	11.56
2781	IT-ADV NET	13.33	16.41	14.96	24.04	22.88	18.32
3910	IS-IMAGE	13.24	15.3	14.89	11.21	14.86	13.9
3924	IS-NTCS	18.5	16.04	19.28	9.56	9.2	14.52
5326	SO-SEAL	3.03	6.18	6.32	6.9	6.25	5.74
5343	ND-SECOND	1.12	0.91	1.18	19.64	27.56	10.08
5352	SB-SWCC AD	0	4.52	8.57	2.6	0	3.14
8425	HM-SW IDC	35.39	28.57	40.67	31.27	33.93	33.97
8432	HM-PREV	46.41	30.77	39.47	43.82	51.46	42.39
8452	HM-XRAY AD	61.69	39.76	57.48	71.26	58.4	57.72
8482	HM-PHARM	31.58	39.46	37.35	40.91	38.16	37.49
8483	HM-SURG	38.57	33.86	40.19	37.23	39.23	37.82
8506	HM-MED TEC	41.06	29.98	39.1	41.57	42.31	38.8
9138	CTR-A&R	15.87	15.64	15.32	24.88	27.05	19.75
9147	CTR-INTSIG	46.85	39.76	42.14	40.53	40.97	42.05
Average		23.9	20.8	24.6	26.5	27.0	24.6

Source: Author Created from ROGER model output

B. ROGER MODEL PREDICTIONS OF SRB TAKERS

The second output created by the ROGER model is the predicted number of SRB takers. This section of the analysis will look at the difference between the baseline taker predictions and the taker predictions from the "modified" databases. Those differences will be compared to the actual takers for each fiscal year to determine the reduction in prediction error from using the modified databases.

1. Comparison of SRB Taker Predictions from ROGER Model Based on Baseline, Average Graduates, and Planned Graduates

Tables 21–23 show the actual change in the number of predicted takers using the modified databases, and Table 24 shows the percentage change in

predicted takers from the baseline when using the modified databases. As with the changes in the eligible pools, the change in the ROGER model's SRB taker predictions varied across NECs. In addition, an important item to note is the data shows that there is no determinable constant difference between predictions based on the calculated number of planned graduates and the number of graduates using the previous two-year average. It was hypothesized that the calculated planned graduate numbers would work better than the average number of graduates at reducing the prediction error, but the data in Tables 21–23 show the effects to be very similar.

Looking at Tables 21–23, none of the NECs showed large increases in the number of predicted takers. The highest increase in predicted number of takers was 27 for NEC 2780 in FY08, which represented 21% of the baseline predicted takers. While the total increase in predicted takers were not very high, some of the NECs had large percentage increases in predicted takers from the baseline numbers. The overall percentage increase in the predicted takers was the highest for the HM NEC 8425 (with 300% to 400% increases), but the baseline predicted takers for this NEC was also extremely low each fiscal year (ranging from 4 to 6 predicted takers).

Table 21. ROGER Model Predicted Number of SRB Takers, FY06

NEC	Descriptor	Baseline Predicted Takers (1)	Predicted Takers Using Average Graduates (2)	Increase in Predicted Takers Using Average Graduates =(2-1)
2735	IT-SYS AD	109	115	6
2780	IT-NET SEC	8	13	5
2781	IT-ADV NET	27	36	9
3910	IS-IMAGE	35	48	13
3924	IS-NTCS	41	57	16
5326	SO-SEAL	65	66	1
5343	ND-SECOND	28	28	0
5352	SB-SWCC AD	50	50	0
8425	HM-SW IDC	4	20	16
8432	HM-PREV	26	33	7
8452	HM-XRAY AD	22	33	11
8482	HM-PHARM	46	48	2
8483	HM-SURG	71	80	9
8506	HM-MED TEC	48	56	8
9138	CTR-A&R	14	16	2
9147	CTR-INTSIG	22	32	10

Source: Author Created from ROGER model output

Table 22. ROGER Model Predicted Number of SRB Takers, FY07

NEC	Descriptor	Baseline Predicted Takers (1)	Average Graduates Predicted Takers (2)	Planned Graduates Predicted Takers (3)	Average Graduates Change from Baseline (2-1)	Planned Graduates Change from Baseline (3-1)
2735	IT-SYS AD	131	138	134	7	3
2780	IT-NET SEC	49	63	70	14	21
2781	IT-ADV NET	28	40	43	12	15
3910	IS-IMAGE	18	27	20	9	2
3924	IS-NTCS	39	52	57	13	18
5326	SO-SEAL	64	66	66	2	2
5343	ND-SECOND	9	9	9	0	0
5352	SB-SWCC AD	51	54	54	3	3
8425	HM-SW IDC	6	24	24	18	18
8432	HM-PREV	33	39	40	6	7
8452	HM-XRAY AD	15	27	27	12	12
8482	HM-PHARM	53	57	57	4	4
8483	HM-SURG	90	102	103	12	13
8506	HM-MED TEC	57	67	66	10	9
9138	CTR-A&R	34	39	40	5	6
9147	CTR-INTSIG	41	55	56	14	15

Source: Author Created from ROGER model output

Table 23. ROGER Model Predicted Number of SRB Takers, FY08

NEC	Descriptor	Baseline Predicted Takers (1)	Average Graduates Predicted Takers (2)	Planned Graduates Predicted Takers (3)	Average Graduates Change from Baseline (2-1)	Planned Graduates Change from Baseline (3-1)
2735	IT-SYS AD	210	224	233	14	23
2780	IT-NET SEC	86	113	104	27	18
2781	IT-ADV NET	44	60	67	16	23
3910	IS-IMAGE	21	26	24	5	3
3924	IS-NTCS	67	78	76	11	9
5326	SO-SEAL	209	215	215	6	6
5343	ND-SECOND	56	67	74	11	18
5352	SB-SWCC AD	62	62	62	0	0
8425	HM-SW IDC	6	28	26	22	20
8432	HM-PREV	36	47	47	11	11
8452	HM-XRAY AD	11	29	27	18	16
8482	HM-PHARM	54	60	61	6	7
8483	HM-SURG	86	99	100	13	14
8506	HM-MED TEC	91	108	109	17	18
9138	CTR-A&R	33	45	49	12	16
9147	CTR-INTSIG	62	85	84	23	22

Source: Author Created from ROGER model output

Over the past few years, the managers of the ROGER model have been increasing the taker projections by certain arbitrary percentages to help account for some of the missed takers. Since FY06, the ROGER model taker predictions have been adjusted upwards by 30% or more across all ratings and NECs (except NUCs) to try to account for the under-predictions by the ROGER model.

Table 24 gives the percentage increase in the number of predicted takers using the “modified” databases. This table allows for a comparison of the usefulness of the “modified” databases to the current method of using a fixed across-the-board percentage increase in predicted takers. Using the modified databases increased the predicted number of SRB takers by anywhere from 0 to 400%, with the average increase in predicted takers for each fiscal year being between 40.9% and 51%. However, by dropping NEC 8425, which had a huge

percentage increase due to the low initial projections, the average percentage increase in predicted takers is between 23.3% and 30.4%. This data implies that using the modified databases are no more effective at increasing the number of predicted takers than by just applying the current fixed increase of around 30%.

Table 24. Percentage Change in Predicted Number of SRB Takers from Modified and Baseline Models, FY06-08

NEC	Descriptor	FY06 Average Graduates	FY07 Average Graduates	FY07 Planned Graduates	FY08 Average Graduates	FY08 Planned Graduates
2735	IT-SYS AD	5.5 %	5.3 %	2.3 %	6.7 %	11.0 %
2780	IT-NET SEC	62.5	28.6	42.9	31.4	20.9
2781	IT-ADV NET	33.3	42.9	53.6	36.4	52.3
3910	IS-IMAGE	37.1	50.0	11.1	23.8	14.3
3924	IS-NTCS	39.0	33.3	46.2	16.4	13.4
5326	SO-SEAL	1.5	3.1	3.1	2.9	2.9
5343	ND-SECOND	0.0	0.0	0.0	19.6	32.1
5352	SB-SWCC AD	0.0	5.9	5.9	0.0	0.0
8425	HM-SW IDC	400.0	300.0	300.0	366.7	333.3
8432	HM-PREV	26.9	18.2	21.2	30.6	30.6
8452	HM-XRAY AD	50.0	80.0	80.0	163.6	145.5
8482	HM-PHARM	4.3	7.5	7.5	11.1	13.0
8483	HM-SURG	12.7	13.3	14.4	15.1	16.3
8506	HM-MED TEC	16.7	17.5	15.8	18.7	19.8
9138	CTR-A&R	14.3	14.7	17.6	36.4	48.5
9147	CTR-INTSIG	45.5	34.1	36.6	37.1	35.5
Average All		**46.8**	**40.9**	**41.1**	**51.0**	**49.3**
Average Dropping NEC 8425		**23.3**	**23.6**	**23.9**	**30.0**	**30.4**

Source: Author Created from ROGER model output

2. Comparison of Number of Taker Predictions from ROGER to Actual Takers, FY06-FY08

Tables 25–27 compare the actual takers to the predicted takers using the "modified" databases for FY06 to FY08. For the most part, the data shows that using the modified databases reduces the error between predicted takers and actual takers by a small amount. At the same time, for some NECs, there is an increase in error from using the modified databases.

The total percentage error change from the baseline taker predictions ranged from a reduction of 32.5 percentage points to an increase of 26.2 percentage points, with the average being an error reduction of 8.6 percentage points. An 8.6 percentage point reduction in the error of missed takers seems to be minimal compared to the amount of work to compile and incorporate the CeTARS data into the EMR snapshot. There are five instances where the error increased (out of the 80 projections) and these are split across only three NECs. The increases in error from using the modified databases are shown in bold in Table 28

Table 25. Comparison of Actual and Predicted Number of SRB Takers, FY06

NEC	Descriptor	FY06 Actual SRB Takers (1)	FY06 Baseline Predicted Takers (2)	FY06 Average Graduates Predicted Takers (3)	Baseline – Actual: =(2-1)	Average Graduates – Actual: =(3-1)	Percent Error Using Baseline	Percent Error Using Average Graduates
2735	IT-SYS AD	190	109	115	-81	-75	-42.6 %	-39.5 %
2780	IT-NET SEC	187	8	13	-179	-174	-95.7	-93.0
2781	IT-ADV NET	59	27	36	-32	-23	-54.2	-39.0
3910	IS-IMAGE	40	35	48	-5	***8***	-12.5	***20.0***
3924	IS-NTCS	99	41	57	-58	-42	-58.6	-42.4
5326	SO-SEAL	200	65	66	-135	-134	-67.5	-67.0
5343	ND-SECOND	73	28	28	-45	-45	-61.6	-61.6
5352	SB-SWCC AD	51	50	50	-1	-1	-2.0	-2.0
8425	HM-SW IDC	148	4	20	-144	-128	-97.3	-86.5
8432	HM-PREV	114	26	33	-88	-81	-77.2	-71.1
8452	HM-XRAY AD	87	22	33	-65	-54	-74.7	-62.1
8482	HM-PHARM	19	46	48	27	***29***	142.1	***152.6***
8483	HM-SURG	142	71	80	-71	-62	-50.0	-43.7
8506	HM-MED TEC	168	48	56	-120	-112	-71.4	-66.7
9138	CTR-A&R	91	14	16	-77	-75	-84.6	-82.4
9147	CTR-INTSIG	39	22	32	-17	-7	-43.6	-17.9

Source: Author Created from ROGER model output

Table 26. Comparison of Actual and Predicted Number of SRB Takers, FY07

NEC	Descriptor	FY07 Actual SRB Takers	FY07 Baseline Minus Actual	FY07 Average Graduates Minus Actual	FY07 Planned Graduates Minus Actual	Percent Error Using Baseline	Percent Error Using Average Graduates	Percent Error Using Planned Graduates
2735	IT-SYS AD	200	-69	-62	-66	-34.5 %	-31.0 %	-33.0 %
2780	IT-NET SEC	164	-115	-101	-94	-70.1	-61.6	-57.3
2781	IT-ADV NET	100	-72	-60	-57	-72.0	-60.0	-57.0
3910	IS-IMAGE	34	-16	-7	-14	-47.1	-20.6	-41.2
3924	IS-NTCS	95	-56	-43	-38	-58.9	-45.3	-40.0
5326	SO-SEAL	229	-165	-163	-163	-72.1	-71.2	-71.2
5343	ND-SECOND	60	-51	-51	-51	-85.0	-85.0	-85.0
5352	SB-SWCC AD	63	-12	-9	-9	-19.0	-14.3	-14.3
8425	HM-SW IDC	177	-171	-153	-153	-96.6	-86.4	-86.4
8432	HM-PREV	131	-98	-92	-91	-74.8	-70.2	-69.5
8452	HM-XRAY AD	132	-117	-105	-105	-88.6	-79.5	-79.5
8482	HM-PHARM	56	-3	1	1	-5.4	1.8	1.8
8483	HM-SURG	139	-49	-37	-36	-35.3	-26.6	-25.9
8506	HM-MED TEC	222	-165	-155	-156	-74.3	-69.8	-70.3
9138	CTR-A&R	84	-50	-45	-44	-59.5	-53.6	-52.4
9147	CTR-INTSIG	56	-15	-1	0	-26.8	-1.8	0.0

Source: Author Created from ROGER model output

Table 27. Comparison of Actual and Predicted Number of SRB Takers, FY08

NEC	Descriptor	FY08 Actual SRB Takers	FY08 Baseline Minus Actual	FY08 Average Graduates Minus Actual	FY08 Planned Graduates Minus Actual	Percent Error Using Baseline	Percent Error Using Average Graduates	Percent Error Using Planned Graduates
2735	IT-SYS AD	278	-68	-54	-45	-24.5 %	-19.4 %	-16.2 %
2780	IT-NET SEC	115	-29	-2	-11	-25.2	-1.7	-9.6
2781	IT-ADV NET	137	-93	-77	-70	-67.9	-56.2	-51.1
3910	IS-IMAGE	61	-40	-35	-37	-65.6	-57.4	-60.7
3924	IS-NTCS	87	-20	-9	-11	-23.0	-10.3	-12.6
5326	SO-SEAL	254	-45	-39	-39	-17.7	-15.4	-15.4
5343	ND-SECOND	64	-8	3	***10***	-12.5	4.7	***15.6***
5352	SB-SWCC AD	77	-15	-15	-15	-19.5	-19.5	-19.5
8425	HM-SW IDC	70	-64	-42	-44	-91.4	-60.0	-62.9
8432	HM-PREV	118	-82	-71	-71	-69.5	-60.2	-60.2
8452	HM-XRAY AD	147	-136	-118	-120	-92.5	-80.3	-81.6
8482	HM-PHARM	70	-16	-10	-9	-22.9	-14.3	-12.9
8483	HM-SURG	158	-72	-59	-58	-45.6	-37.3	-36.7
8506	HM-MED TEC	197	-106	-89	-88	-53.8	-45.2	-44.7
9138	CTR-A&R	61	-28	-16	-12	-45.9	-26.2	-19.7
9147	CTR-INTSIG	65	-3	***20***	***19***	-4.6	***30.8***	***29.2***

Source: Author Created from ROGER model output

Table 28. Change in Predicted Taker Error from Baseline Using Modified Databases, FY06-08

NEC	Descriptor	FY06 Average Graduates	FY07 Average Graduates	FY07 Planned Graduates	FY08 Average Graduates	FY08 Planned Graduates
2735	IT-SYS AD	-3.2	-3.5	-1.5	-5.0	-8.3
2780	IT-NET SEC	-2.7	-8.5	-12.8	-23.5	-15.7
2781	IT-ADV NET	-15.3	-12.0	-15.0	-11.7	-16.8
3910	IS-IMAGE	-32.5	-26.5	-5.9	-8.2	-4.9
3924	IS-NTCS	-16.2	-13.7	-18.9	-12.6	-10.3
5326	SO-SEAL	-0.5	-0.9	-0.9	-2.4	-2.4
5343	ND-SECOND	0.0	0.0	-0.0	-7.8	***3.1***
5352	SB-SWCC AD	0.0	-4.8	-4.8	0.0	0.0
8425	HM-SW IDC	-10.8	-10.2	-10.2	-31.4	-28.6
8432	HM-PREV	-6.1	-4.6	-5.3	-9.3	-9.3
8452	HM-XRAY AD	-12.6	-9.1	-9.1	-12.2	-10.9
8482	HM-PHARM	***10.5***	-7.1	-7.1	-8.6	-10.0
8483	HM-SURG	-6.3	-8.6	-9.4	-8.2	-8.9
8506	HM-MED TEC	-4.8	-4.5	-4.1	-8.6	-9.1
9138	CTR-A&R	-2.2	-6.0	-7.1	-19.7	-26.2
9147	CTR-INTSIG	-25.6	-25.0	-26.8	***26.2***	***24.6***

Source: Author Created from ROGER model output

While the total error reduction is important, the actual impact on the number of missed takers is the primary focus for this thesis. Tables 29-32 display the percentage of missed takers that were accounted for by using the "modified" databases. The tables reveal a lot of variance in the ability of the "modified" databases to account for the missed takers, not only across each NEC but also across the fiscal years. Over half of the "modified" taker predictions accounted for less than 20% of the missed takers, while three-quarters of all the "modified" taker predictions accounted for less than 40% of the missed takers.

While most of the NECs accounted for small percentages of the missed takers, some of the NECs show large percentage increases, but these large changes tend to be in those NECs with small numbers of missed takers using

the baseline database. One example is NEC 9147 in FY08, where the baseline predictions missed three takers and then the modified databases over-predicted by 20.

Table 29. Percentage of Missed Takers Accounted For Using Modified Database, FY06

NEC	Descriptor	FY06 Missed Takers Using Baseline	FY06 Predicted Taker Increase using Average Graduates	Percent Missed Takers
2735	IT-SYS AD	-81	6	7.4 %
2780	IT-NET SEC	-179	5	2.8
2781	IT-ADV NET	-32	9	28.1
3910	IS-IMAGE	-5	13	260.0
3924	IS-NTCS	-58	16	27.6
5326	SO-SEAL	-135	1	0.7
5343	ND-SECOND	-45	0	0.0
5352	SB-SWCC AD	-1	0	0.0
8425	HM-SW IDC	-144	16	11.1
8432	HM-PREV	-88	7	8.0
8452	HM-XRAY AD	-65	11	16.9
8482	HM-PHARM	27	2	7.4
8483	HM-SURG	-71	9	12.7
8506	HM-MED TEC	-120	8	6.7
9138	CTR-A&R	-77	2	2.6
9147	CTR-INTSIG	-17	10	58.8

Source: Author Created from ROGER model output

Table 30. Percentage of Missed Takers Accounted For Using Modified Database, FY07

NEC	Descriptor	FY07 Missed Takers Using Baseline	FY07 Average Graduates Predicted Taker Increase	FY07 Planned Graduates Predicted Taker Increase	Average Graduates Percent Missed Takers	Planned Graduates Percent Missed Takers
2735	IT-SYS AD	-69	7	3	10.1 %	4.3 %
2780	IT-NET SEC	-115	14	21	12.2	18.3
2781	IT-ADV NET	-72	12	15	16.7	20.8
3910	IS-IMAGE	-16	9	2	56.3	12.5
3924	IS-NTCS	-56	13	18	23.2	32.1
5326	SO-SEAL	-165	2	2	1.2	1.2
5343	ND-SECOND	-51	0	0	0.0	0.0
5352	SB-SWCC AD	-12	3	3	25.0	25.0
8425	HM-SW IDC	-171	18	18	10.5	10.5
8432	HM-PREV	-98	6	7	6.1	7.1
8452	HM-XRAY AD	-117	12	12	10.3	10.3
8482	HM-PHARM	-3	4	4	133.3	133.3
8483	HM-SURG	-49	12	13	24.5	26.5
8506	HM-MED TEC	-165	10	9	6.1	5.5
9138	CTR-A&R	-50	5	6	10.0	12.0
9147	CTR-INTSIG	-15	14	15	93.3	100.0

Source: Author Created from ROGER model output

Table 31. Percentage of Missed Takers Accounted For Using Modified Database, FY08

NEC	Descriptor	FY08 Baseline Minus Actual	FY08 Average Graduates Predicted Taker Increase	FY08 Planned Graduates Predicted Taker Increase	Average Graduates Percent Missed Takers	Planned Graduates Percent Missed Takers
2735	IT-SYS AD	-68	14	23	20.6 %	33.8 %
2780	IT-NET SEC	-29	27	18	93.1	62.1
2781	IT-ADV NET	-93	16	23	17.2	24.7
3910	IS-IMAGE	-40	5	3	12.5	7.5
3924	IS-NTCS	-20	11	9	55.0	45.0
5326	SO-SEAL	-45	6	6	13.3	13.3
5343	ND-SECOND	-8	11	18	137.5	225.0
5352	SB-SWCC AD	-15	0	0	0.0	0.0
8425	HM-SW IDC	-64	22	20	34.4	31.3
8432	HM-PREV	-82	11	11	13.4	13.4
8452	HM-XRAY AD	-136	18	16	13.2	11.8
8482	HM-PHARM	-16	6	7	37.5	43.8
8483	HM-SURG	-72	13	14	18.1	19.4
8506	HM-MED TEC	-106	17	18	16.0	17.0
9138	CTR-A&R	-28	12	16	42.9	57.1
9147	CTR-INTSIG	-3	23	22	766.7	733.3

Source: Author Created from ROGER model output

Table 32. Compiled Percentage of Missed Takers Accounted for Using the Modified Databases, FY06-FY08

NEC	Descriptor	FY06 Average Graduates	FY07 Average Graduates	FY07 Planned Graduates	FY08 Average Graduates	FY08 Planned Graduates
2735	IT-SYS AD	7.4 %	10.1 %	4.3 %	20.6 %	33.8 %
2780	IT-NET SEC	2.8	12.2	18.3	93.1	62.1
2781	IT-ADV NET	28.1	16.7	20.8	17.2	24.7
3910	IS-IMAGE	260.0	56.3	12.5	12.5	7.5
3924	IS-NTCS	27.6	23.2	32.1	55.0	45.0
5326	SO-SEAL	0.7	1.2	1.2	13.3	13.3
5343	ND-SECOND	0.0	0.0	0.0	137.5	225.0
5352	SB-SWCC AD	0.0	25.0	25.0	0.0	0.0
8425	HM-SW IDC	11.1	10.5	10.5	34.4	31.3
8432	HM-PREV	8.0	6.1	7.1	13.4	13.4
8452	HM-XRAY AD	16.9	10.3	10.3	13.2	11.8
8482	HM-PHARM	7.4	133.3	133.3	37.5	43.8
8483	HM-SURG	12.7	24.5	26.5	18.1	19.4
8506	HM-MED TEC	6.7	6.1	5.5	16.0	17.0
9138	CTR-A&R	2.6	10.0	12.0	42.9	57.1
9147	CTR-INTSIG	58.8	93.3	100.0	766.7	733.3

Source: Author Created from ROGER model output

C. BUDGET ANALYSIS

As seen in Tables 33–35 using the modified databases increased the annual budget predictions across-the-board. The budget prediction for FY06 increased by 20% using average graduates, while the budget prediction for FY07 increased by 25% using average graduates and 27% using planned graduates. The budget prediction for FY08 increased by 17% using average graduates and 18% using planned graduates. These are fairly large increases in the predicted budgets, but they do not seem to increase linearly with the increase in the predicted number of takers. This is because, while the average change in the predicted number of takers may have been in the 40 and 50 percentiles, this average increase was not the same for every NEC, and each NEC has different

costs per taker. Some of the high-cost NECs may have no increase in their budget costs, while other low-cost NECs may have a 200% increase from their original budget.

Table 33. SRB Budget Predictions ($ Thousands), FY06

NEC	Descriptor	Baseline	Average Graduates	Difference
2735b	IT-SYS AD	$1024	$1124	$100
2780b	IT-NET SEC	146	237	91
2781	IT-ADV NET	512	661	149
3910	IS-IMAGE	471	654	183
3924	IS-NTCS	789	1107	318
5326	SO-SEAL	1923	1946	23
5343	ND-SECOND	595	595	0
5352	SB-SWCC AD	744	744	0
8425	HM-SW IDC	95	422	327
8432	HM-PREV	320	359	39
8452	HM-XRAY AD	288	383	95
8482	HM-PHARM	61	68	7
8483	HM-SURG	409	493	84
8506	HM-MED TEC	567	691	124
9138	CTR-A&R	197	212	15
9147	CTR-INTSIG	69	136	67
	Total	$8210	$9832	$1622
		Percentage Increase Over Baseline		**20%**

Source: Author Created from ROGER model output

Table 34. SRB Budget Predictions ($ Thousands), FY07

NEC	Descriptor	Baseline	Average Graduates	Difference Average Graduates to Baseline	Planned Graduates	Difference Planned Graduates to Baseline	Planned Graduates Minus Average Graduates
2735b	IT-SYS AD	$681	$731	$50	$707	$26	-$24
2780b	IT-NET SEC	544	700	156	786	242	86
2781	IT-ADV NET	502	671	169	718	216	47
3910	IS-IMAGE	184	311	127	208	24	-103
3924	IS-NTCS	768	1014	246	1119	351	105
5326	SO-SEAL	1037	1124	87	1124	87	0
5343	ND-SECOND	185	186	1	186	1	0
5352	SB-SWCC AD	1075	1144	69	1126	51	-18
8425	HM-SW IDC	123	483	360	489	366	6
8432	HM-PREV	448	514	66	525	77	11
8452	HM-XRAY AD	260	382	122	382	122	0
8482	HM-PHARM	93	106	13	107	14	1
8483	HM-SURG	452	569	117	583	131	14
8506	HM-MED TEC	873	1044	171	1038	165	-6
9138	CTR-A&R	262	311	49	324	62	13
9147	CTR-INTSIG	40	144	104	144	104	0
	Total	$7527	$9434	$1907	$9566	$2039	$132
		Percent Increase Over Baseline		**25%**		**27%**	

Source: Author Created from ROGER model output

Table 35. SRB Budget Predictions ($ Thousands), FY08

NEC	Descriptor	Baseline	Average Graduates	Difference Average Graduates to Baseline	Planned Graduates	Difference Planned Graduates to Baseline	Planned Graduates Minus Average Graduates
2735b	IT-SYS AD	$1835	$2136	$301	$2236	$401	$100
2780b	IT-NET SEC	923	1227	304	1134	211	-93
2781	IT-ADV NET	795	1083	288	1207	412	124
3910	IS-IMAGE	553	679	126	635	82	-44
3924	IS-NTCS	1812	2103	291	2055	243	-48
5326	SO-SEAL	8910	9143	233	9143	233	0
5343	ND-SECOND	1450	1769	319	1970	520	201
5352	SB-SWCC AD	1809	1825	16	1809	0	-16
8425	HM-SW IDC	144	620	476	576	432	-44
8432	HM-PREV	586	715	129	709	123	-6
8452	HM-XRAY AD	209	564	355	523	314	-41
8482	HM-PHARM	381	434	53	436	55	2
8483	HM-SURG	905	1104	199	1115	210	11
8506	HM-MED TEC	1611	1951	340	1964	353	13
9138	CTR-A&R	515	721	206	777	262	56
9147	CTR-INTSIG	947	1271	324	1264	317	-7
	Total	$23385	$27345	$3960	$27553	$4168	$208
		Percentage Increase Over Baseline		17%		18%	

Source: Author Created from ROGER model output

D. ANALYSIS OF INCREASING THE BASELINE NUMBER OF PREDICTED TAKERS BY A SET PERCENTAGE

As stated previously, over the past few years the managers of the ROGER model have been increasing the taker projections by fixed percentages to help account for some of the missed takers. Since FY06, the ROGER model taker predictions have been adjusted upwards by 30% or more across all ratings and NECs (except NUCs) in order to try to account for the under-predictions by the ROGER model.

The data in Tables 36-38 show that the number of missed takers varies greatly across each NEC and fiscal year. This shows that applying a fixed percentage increase in taker predictions will not be effective in accounting for the missed takers. At the same time, using the CeTARS data in the ROGER model database had minimal effect upon accounting for the missed takers. By looking at Table 38, it is easy to see that for most NECs the predictions from the modified databases fell well short of being able to account for the missed takers in each fiscal year. While increasing the predicted number of takers may not give an exact accounting of the missed number of SRB takers, applying a set percentage increase across-the-board is easier, requires fewer man-hours, and is more cost-effective than incorporating the CeTARS data into the ROGER model databases.

Increasing the predicted number of takers by an arbitrary fixed percentage does help increase the overall budget, but another more accurate method to account for the missed takers would be to determine the historical number of missed takers for each NEC and incorporate a percentage of these missed takers into the baseline predicted number of takers for each NEC. This seems a more accurate solution than using the databases modified with CeTARS graduation data or the current practice of increasing the ROGER model predictions by a fixed factor as it will allow for input of a percentage of the direct historical number of missed takers. Table 36 shows the large differences between the ROGER model's baseline predicted number of SRB takers and the missed number of actual SRB takers. NECs 2780 is prime example of why applying a fixed percentage increase to predicted SRB takers is ineffective as its predicted takers were only 8, but the number of missed SRB takers was 179. Increasing the ROGER model taker predictions by a percentage of the missed taker numbers would be a closer fit than just increasing the number of predicted takers by a fixed percentage as it will be using a percentage of the actual error.

Table 36. Number of Baseline Predicted SRB Takers and Missed SRB Takers, FY06-FY08

NEC	Descriptor	FY06 Baseline Predicted Takers	FY06 Missed Takers	FY07 Baseline Predicted Takers	FY07 Missed Takers	FY08 Baseline Predicted Takers	FY08 Missed Takers
2735	IT-SYS AD	109	-81	131	-69	210	-68
2780	IT-NET SEC	8	-179	49	-115	86	-29
2781	IT-ADV NET	27	-32	28	-72	44	-93
3910	IS-IMAGE	35	-5	18	-16	21	-40
3924	IS-NTCS	41	-58	39	-56	67	-20
5326	SO-SEAL	65	-135	64	-165	209	-45
5343	ND-SECOND	28	-45	9	-51	56	-8
5352	SB-SWCC AD	50	-1	51	-12	62	-15
8425	HM-SW IDC	4	-144	6	-171	6	-64
8432	HM-PREV	26	-88	33	-98	36	-82
8452	HM-XRAY AD	22	-65	15	-117	11	-136
8482	HM-PHARM	46	27	53	-3	54	-16
8483	HM-SURG	71	-71	90	-49	86	-72
8506	HM-MED TEC	48	-120	57	-165	91	-106
9138	CTR-A&R	14	-77	34	-50	33	-28
9147	CTR-INTSIG	22	-17	41	-15	62	-3

Source: Author Created from ROGER model output

Table 37. Missed Takers as a Percentage of Baseline Predicted Takers, FY06-FY08

NEC	Descriptor	FY06	FY07	FY08	Average
2735	IT-SYS AD	74.3 %	52.7 %	32.4 %	53.1 %
2780	IT-NET SEC	2237.5	234.7	33.7	835.3
2781	IT-ADV NET	118.5	257.1	211.4	195.7
3910	IS-IMAGE	14.3	88.9	190.5	97.9
3924	IS-NTCS	141.5	143.6	29.9	105.0
5326	SO-SEAL	207.7	257.8	21.5	162.3
5343	ND-SECOND	160.7	566.7	14.3	247.2
5352	SB-SWCC AD	2.0	23.5	24.2	16.6
8425	HM-SW IDC	3600.0	2850	1066.7	2505.6
8432	HM-PREV	338.5	297	227.8	287.8
8452	HM-XRAY AD	295.5	780	1236.4	770.6
8482	HM-PHARM	58.7	5.7	29.6	31.3
8483	HM-SURG	100.0	54.4	83.7	79.4
8506	HM-MED TEC	250.0	289.5	116.5	218.7
9138	CTR-A&R	550.0	147.1	84.8	260.6
9147	CTR-INTSIG	77.3	36.6	4.8	39.6

Source: Author Created from ROGER model output

Table 38. Percentage of Missed Takers Accounted for Using Modified Databases, FY06-FY08

NEC	Descriptor	FY06 Average Graduates	FY07 Average Graduates	FY07 Planned Graduates	FY08 Average Graduates	FY08 Planned Graduates
2735	IT-SYS AD	7.4 %	10.1 %	4.3 %	20.6 %	33.8 %
2780	IT-NET SEC	2.8	12.2	18.3	93.1	62.1
2781	IT-ADV NET	28.1	16.7	20.8	17.2	24.7
3910	IS-IMAGE	260.0	56.3	12.5	12.5	7.5
3924	IS-NTCS	27.6	23.2	32.1	55.0	45.0
5326	SO-SEAL	0.7	1.2	1.2	13.3	13.3
5343	ND-SECOND	0.0	0.0	0.0	137.5	225.0
5352	SB-SWCC AD	0.0	25.0	25.0	0.0	0.0
8425	HM-SW IDC	11.1	10.5	10.5	34.4	31.3
8432	HM-PREV	8.0	6.1	7.1	13.4	13.4
8452	HM-XRAY AD	16.9	10.3	10.3	13.2	11.8
8482	HM-PHARM	7.4	133.3	133.3	37.5	43.8
8483	HM-SURG	12.7	24.5	26.5	18.1	19.4
8506	HM-MED TEC	6.7	6.1	5.5	16.0	17.0
9138	CTR-A&R	2.6	10.0	12.0	42.9	57.1
9147	CTR-INTSIG	58.8	93.3	100.0	766.7	733.3

Source: Author Created from ROGER model output

E. CHAPTER SUMMARY

Running the ROGER model using the databases modified with CeTARS graduation data caused an average increase in the eligibles pools from 25 to 27%. At the same time, only 21 to 27% of the personnel assigned new NECs were selected as eligible by the ROGER model. The low eligibility selection of those who were assigned an NEC was in part due to the random assignment across the database in the pool of those personnel that qualified to obtain the NEC. Therefore, it is possible the NEC assignment method played a large role in the selection of the eligibles pool. Assigning the NECs to only those personnel who are in the reenlistment window should greatly increase the percentage of new NEC holders selected as eligible; however, at the same time, it may overstate the number who obtain an NEC and are SRB-eligible in the same year.

Using the modified databases did reduce the error in the number of missed takers by an average reduction of 8.6 percentage points. However, in a couple of cases, using the modified databases caused an in increase in the percentage of error for the missed takers. While using the modified databases reduced the overall error for missed takers, it showed no better ability to account for the missed takers than the current practice of increasing the predicted takers by a fixed percentage. In addition, it was hypothesized that the data on planned graduates would be better at accounting for the missed takers, but the data shows that there was little difference between the planned graduate data and the historical average graduate data.

Using the modified databases increased the fiscal year predicted budgets from 17 to 27%, but the increases did not coincide with the increases in the average number of predicted takers. The difference between the overall percentage change in predicted budgets and the overall percentage change in predicted takers was caused from the varying effects of the modified databases on each NECs predicted takers and the differences in SRB costs for each NEC.

This analysis used only 16 of the 116 NECs on the SRB eligibility list. It is possible that the small sample size used in this study skewed the results. Another more comprehensive study involving all of the NECs may show different results.

Another option for accounting for the missed takers would be to determine each NEC's historical number of missed takers and incorporate a percentage of these missed takers into each NEC's baseline predicted takers. This seems a more viable solution than using the databases modified with CeTARS graduation data or the standard approach of increasing ROGER model predictions as it will allow for input of a percentage of the historical error of missed takers by NEC.

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V. SUMMARY AND RECOMMENDATIONS

A. CONCLUSIONS

Over the past few years, the predictions of SRB takers have been adjusted upwards by an arbitrary fixed percentage to account for the missed takers in the ROGER model. These arbitrary adjustments have been applied across the entire database as a band-aid for the inaccuracies in the current SRB prediction model. One of the potential factors affecting the mis-predictions by the ROGER model is believed to be the acquisition of SRB-eligible NEC/skills during the projected fiscal year. The purpose of this thesis was to determine if incorporating NEC acquisition data into the ROGER models database would create more accurate taker predictions.

While the average error in the number of predicted takers was reduced by 8.6 percentage points, the effects varied greatly across NECs and did not show any improvement as compared to the current practice of increasing the predicted takers by a fixed percentage. Even so, this analysis used only a small portion of the NECs on the SRB list, which could have affected the overall results. Perhaps the analysis of a larger number of NECs from the SRB list would prove the modified database method to be more productive at reducing predicted taker error. There are still other potential factors affecting the ROGER model's prediction ability, but these were beyond the scope of this thesis.

B. RECOMMENDATIONS

1. ROGER Model

With the fluidity and differences in reenlistment policies across NECs, it is all but impossible to exactly predict the total number of SRB takers for a given year. The differences in reenlistment policies greatly affect the ROGER model's ability to select all eligibles, which, in turn, affects the SRB-taker and budget

projections. This analysis showed some improvement in predictions by incorporating NEC/skill acquisition data into the ROGER model, but the overall effects were small and varied greatly across NECs. It is recommended that, in the short run, the managers of the ROGER model continue to use the fixed adjustment factor in taker projections to account for the missed taker error until a more precise solution is found.

Another recommended option for accounting for the missed takers would be to determine the historical number of missed takers for each NEC, and incorporate a percentage of these missed takers into each NEC's baseline number of predicted takers. This seems a potentially more viable solution than using the databases modified with CeTARS graduation data or the current practice of applying an arbitrary fixed factor, as it will allow for input of a percentage of the actual number of missed takers. The missed takers were shown in this study to be, in many cases, a few hundred to a few thousand percent of the baseline predicted takers. The difference in size of the predicted taker and missed taker numbers shows that incorporating a fixed percentage of the predicted takers does not accurately account for the actual missed takers.

2. NETC CeTARS Database

One of the major tasks in completing this thesis was the compilation of NEC skill acquisition data. The Navy does not currently have a database that compiles all of the NEC acquisitions that occur every fiscal year. The main historical database for Navy schools, the NETC CeTARS database, has some NECs assigned sporadically throughout the database, but the majority of the courses that award an NEC do not have the NEC assigned to them. This inconsistency led to much confusion during the data collection for this thesis and required the scouring of the database by each individual course code to ensure that all of the graduates for a given NEC were accounted for. If NETC is going to use NECs in the CeTARS database, the NECs should be assigned correctly and completely, otherwise it could lead to incorrect data usage in studies, such as

this one, that utilize NEC data. In addition, the SAG Corporation should be allowed remote access to the NETC CeTARS database to enable data access for follow-on studies involving NEC/skill acquisitions that are needed to improve the ROGER model predictions.

3. Future Research

The following suggestions are provided as recommendations for future research:

- I recommend a more comprehensive analysis as a follow-up to this thesis that involves adding graduation data into the EMR snapshot across all NECs on the SRB list.
- I recommend a similar study be completed with new NECs being assigned to only those individuals in the EMR snapshot who are eligible for reenlistment in that fiscal year. This would allow for analysis of the ROGER model's predictions of SRB-eligible numbers. This would determine if the low selection of eligibles during this analysis is due to the method of NEC assignment or if there is an inherent issue with the ROGER eligibility selection routine.
- I recommend an analysis to determine, by NEC, the percentage of personnel who reenlist for an SRB in the same fiscal year they received a new NEC. This will allow for a correct percentage of graduates to be applied directly to the beginning fiscal year SRB predictions base.

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